

CLAIMS

1. A method for planarizing a semiconductor substrate, comprising:
tracking a signal corresponding to a thickness of a conductive film disposed on the semiconductor substrate;

calculating a second derivative from data representing the tracked signal; and

identifying onset of planarization based upon a change in the second derivative.
2. The method of claim 1, wherein the method operation of tracking a signal corresponding to a thickness of a film disposed on the semiconductor substrate includes,

detecting the signal from a probe that provides a linear response to a remaining amount of the conductive film.
3. The method of claim 2, wherein the probe is an eddy current sensor and the conductive film is a copper film.
4. The method of claim 1, wherein the method operation of calculating a second derivative from data representing the tracked signal includes,

determining a second rate of change of a first rate of change, the first rate of change representing a slope associated with the tracked signal.
5. The method of claim 1, wherein the method operation of identifying onset of planarization based upon a change in the second derivative includes,

establishing a threshold signal level; and
once the threshold signal level is realized, the method includes,
identifying a decrease of a value of the second derivative.

6. The method of claim 5, wherein the method operation of identifying a decrease of a value of the second derivative includes,

establishing a drop level for the value of the second derivative; and
monitoring the value of the second derivative; and
once the value of the second derivative crosses the drop level, the method includes,
adjusting planarization parameters associated with the planarizing operation.

7. The method of claim 1, further comprising:

initiating a chemical mechanical planarization (CMP) operation under a first set of planarization parameters; and
adjusting the CMP operation with a second set of planarization parameters after the onset of planarization.

8. The method of claim 7, wherein the method operation of adjusting the CMP operation with a second set of planarization parameters after the onset of planarization includes,

decreasing both a down force applied to the semiconductor substrate and belt speed.

9. The method of claim 7, the first set of planarization parameters include a first slurry composition and the second set of planarization parameters includes a second slurry, the second slurry being less abrasive than the first slurry.

10. A method for determining when a substantially flat surface of a metal film has been achieved during a chemical mechanical planarization (CMP) operation, comprising:
monitoring a signal corresponding to an amount of metal within a detection region;
determining a rate of change over time of a removal rate;
establishing a threshold decrease associated with the rate of change; and
triggering a transition point when the rate of change crosses the threshold decrease associated with the rate of change.

11. The method of claim 10, wherein the signal responds linearly to a change of an amount of metal within the detection region.

12. The method of claim 10, wherein the method operation of determining a rate of change over time of a removal rate includes,
converting the signal to a second derivative value of the signal; and
tracking the second derivative value of the signal over time.

13. The method of claim 10, wherein in response to the method operation of triggering a transition point when the rate of change crosses the threshold decrease in the rate of change the method includes,

adjusting processing parameters associated with the CMP operation.

14. The method of claim 13, wherein the processing parameters include one of a belt speed and a down force pressure applied to a substrate being processed.

15. The method of claim 10, wherein in response to the method operation of triggering a transition point when the rate of change crosses the threshold decrease in the rate of change the method includes,

stopping the CMP operation; and

changing a current polishing pad to a softer polishing pad.

16. The method of claim 15, further comprising:

replacing a current slurry with a less abrasive slurry.

17. A system for planarizing a semiconductor substrate having a metal film disposed thereon, comprising:

a chemical mechanical planarization (CMP) unit, the CMP unit including,

a polishing pad;

a carrier configured to support the semiconductor substrate over the polishing pad, the carrier having a sensor embedded therein, the sensor configured to detect an amount of metal of the metal film within a detection region of the sensor; and

a controller in communication with the sensor, the controller configured to convert a signal corresponding to the amount of metal of the metal film within the detection region of

the sensor to a second derivative value, the controller further configured to track the second derivative value over time in order to identify a time point where the metal film is substantially flat.

18. The system of claim 17, wherein the sensor is an eddy current sensor.
19. The system of claim 17, wherein the polishing pad is a belt type polishing pad.
20. The system of claim 17, wherein the metal is copper.